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KEY=BIOPHYSICS - FRENCH BALLARD

Trends in Biophysics From Cell Dynamics Toward Multicellular Growth Phenomena CRC Press **This book covers a wide scope of biological approaches to such biological phenomena as cell division, motility, collective cell behavior, multicellular structures, morphogenesis, and tumor development. Over the past two decades, biologists have generated large sets of experimental data and discovered a lot of facts that need explanation. This biological boom attracts physicists who believe they can help to develop a theoretical framework in biology and explain complete biological phenomena using basic principles. This is the first book to present recent advances in biophysical studies of the different aspects of cell life. This book presents recent advances in biophysical studies of living cells and gives the impression that a combination of quantitative live cell observations, detailed biochemical and biophysical data, and mathematical modeling are capable to answer many important biological questions and to achieve a more complete understanding of such complex phenomena. Trends in Biophysics From Cell Dynamics Toward Multicellular Growth Phenomena CRC Press This title includes a number of Open Access chapters. This book covers a wide scope of biological approaches to such biological phenomena as cell division, motility, collective cell behavior, multicellular structures, morphogenesis, and tumor development. Over the past two decades, biologists have generated large sets of experimental data and**

discovered a lot of facts that need explanation. This biological boom attracts physicists who believe they can help to develop a theoretical framework in biology and explain complete biological phenomena using basic principles. This is the first book to present recent advances in biophysical studies of the different aspects of cell life. This book presents recent advances in biophysical studies of living cells and gives the impression that a combination of quantitative live cell observations, detailed biochemical and biophysical data, and mathematical modeling are capable to answer many important biological questions and to achieve a more complete understanding of such complex phenomena. Growth From Microorganisms to Megacities MIT Press A systematic investigation of growth in nature and society, from tiny organisms to the trajectories of empires and civilizations. Growth has been both an unspoken and an explicit aim of our individual and collective striving. It governs the lives of microorganisms and galaxies; it shapes the capabilities of our extraordinarily large brains and the fortunes of our economies. Growth is manifested in annual increments of continental crust, a rising gross domestic product, a child's growth chart, the spread of cancerous cells. In this magisterial book, Vaclav Smil offers systematic investigation of growth in nature and society, from tiny organisms to the trajectories of empires and civilizations. Smil takes readers from bacterial invasions through animal metabolisms to megacities and the global economy. He begins with organisms whose mature sizes range from microscopic to enormous, looking at disease-causing microbes, the cultivation of staple crops, and human growth from infancy to adulthood. He examines the growth of energy conversions and man-made objects that enable economic activities—developments that have been essential to civilization. Finally, he looks at growth in complex systems, beginning with the growth of human populations and proceeding to the growth of cities. He considers the challenges of tracing the growth of empires and civilizations, explaining that we can chart the growth of organisms across individual and evolutionary time, but that the progress of societies and economies, not so linear, encompasses both decline and renewal. The trajectory of modern civilization, driven by competing imperatives of material growth and biospheric limits, Smil tells us, remains uncertain. Artificial Life IV Proceedings of the Fourth International Workshop on the Synthesis and Simulation of Living Systems MIT Press This book brings together contributions to the Fourth Artificial Life Workshop, heldat the Massachusetts Institute of Technology in the summer of 1994. Systems Biology of Tumor Microenvironment Quantitative Modeling and Simulations Springer This edited volume discusses the complexity of tumor microenvironments during cancer development, progression and treatment. Each chapter presents a different mathematical model designed to investigate the interactions between tumor cells and the surrounding stroma and stromal cells. The topics covered in this book include the quantitative image analysis of a tumor microenvironment, the

microenvironmental barriers in oxygen and drug delivery to tumors, the development of tumor microenvironmental niches and sanctuaries, intravenous transport of the circulating tumor cells, the role of the tumor microenvironment in chemotherapeutic interventions, the interactions between tumor cells, the extracellular matrix, the interstitial fluid, and the immune and stromal cells. Mathematical models discussed here embrace both continuous and agent-based approaches, as well as mathematical frameworks of solid mechanics, fluid dynamics and optimal control theory. The topics in each chapter will be of interest to a biological community wishing to apply the mathematical methods to interpret their experimental data, and to a biomathematical audience interested in exploring how mathematical models can be used to address complex questions in cancer biology. Multilevel Organization and Functional Integration in Organisms Frontiers Media SA **Catalyzing Inquiry at the Interface of Computing and Biology** National Academies Press **Advances in computer science and technology and in biology over the last several years have opened up the possibility for computing to help answer fundamental questions in biology and for biology to help with new approaches to computing. Making the most of the research opportunities at the interface of computing and biology requires the active participation of people from both fields. While past attempts have been made in this direction, circumstances today appear to be much more favorable for progress. To help take advantage of these opportunities, this study was requested of the NRC by the National Science Foundation, the Department of Defense, the National Institutes of Health, and the Department of Energy. The report provides the basis for establishing cross-disciplinary collaboration between biology and computing including an analysis of potential impediments and strategies for overcoming them. The report also presents a wealth of examples that should encourage students in the biological sciences to look for ways to enable them to be more effective users of computing in their studies. Advances in Artificial Life 9th European Conference, ECAL 2007, Lisbon, Portugal, September 10-14, 2007, Proceedings** Springer **This book constitutes the refereed proceedings of the 9th European Conference on Artificial Life, ECAL 2007, held in Lisbon, Portugal. The 125 revised full papers cover morphogenesis and development, robotics and autonomous agents, evolutionary computation and theory, cellular automata, models of biological systems and their applications, ant colony and swarm systems, evolution of communication, simulation of social interactions, self-replication, artificial chemistry. Biology: The Dynamic Science** Cengage Learning **Russell/Hertz/McMillan, BIOLOGY: THE DYNAMIC SCIENCE 4e and MindTap teach Biology the way scientists practice it by emphasizing and applying science as a process. You learn not only what scientists know, but how they know it, and what they still need to learn. The authors explain complex ideas clearly and describe how biologists collect and interpret evidence to test hypotheses about the living world. Throughout, Russell and MindTap provide engaging applications, develop quantitative analysis**

and mathematical reasoning skills, and build conceptual understanding. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version. Epigenetics Linking Genotype and Phenotype in Development and Evolution Univ of California Press Illuminating the processes and patterns that link genotype to phenotype, epigenetics seeks to explain features, characters, and developmental mechanisms that can only be understood in terms of interactions that arise above the level of the gene. With chapters written by leading authorities, this volume offers a broad integrative survey of epigenetics. Approaching this complex subject from a variety of perspectives, it presents a broad, historically grounded view that demonstrates the utility of this approach for understanding complex biological systems in development, disease, and evolution. Chapters cover such topics as morphogenesis and organ formation, conceptual foundations, and cell differentiation, and together demonstrate that the integration of epigenetics into mainstream developmental biology is essential for answering fundamental questions about how phenotypic traits are produced. On the Origins and Dynamics of Biodiversity: the Role of Chance Springer Science & Business Media Chance is necessary for living systems – from the cell to organisms, populations, communities and ecosystems. It is at the heart of their evolution and diversity. Long considered contingent on other factors, chance both produces random events in the environment, and is the product of endogenous mechanisms - molecular as well as cellular, demographic and ecological. This is how living things have been able to diversify themselves and survive on the planet. Chance is not something to which Life has been subjected; it is quite simply necessary for Life. The endogenous mechanisms that bring it about are at once the products and the engines of evolution, and they also produce biodiversity. These internal mechanisms – veritable "biological roulettes" - are analogous to the mechanical devices that bring about "physical chance". They can be modeled by analogous mathematical equations. This open the way of a global modeling of biodiversity dynamics, but we need also to gather quantitative data in both the laboratory setting as well as in the field. By examining biodiversity at all scales and all levels, this book seeks to evaluate the breadth of our knowledge on this topical subject, to propose an integrated look at living things, to assess the role of chance in its dynamics, in the evolutionary processes and also to imagine practical consequences on the management of living systems. Cellular Potts Models Multiscale Extensions and Biological Applications CRC Press A flexible, cell-level, and lattice-based technique, the cellular Potts model accurately describes the phenomenological mechanisms involved in many biological processes. Cellular Potts Models: Multiscale Extensions and Biological Applications gives an interdisciplinary, accessible treatment of these models, from the original methodologies to the latest developments. The book first explains the biophysical bases, main merits, and limitations of the cellular Potts

model. It then proposes several innovative extensions, focusing on ways to integrate and interface the basic cellular Potts model at the mesoscopic scale with approaches that accurately model microscopic dynamics. These extensions are designed to create a nested and hybrid environment, where the evolution of a biological system is realistically driven by the constant interplay and flux of information between the different levels of description. Through several biological examples, the authors demonstrate a qualitative and quantitative agreement with the relative experimental data. The cellular Potts model is increasingly being used for the mathematical modeling of a wide range of biological phenomena, including wound healing, tumor growth, and cancer cell migration. This book shows how the cellular Potts model can be used as a framework for model building and how extended models can achieve even better biological practicality, accuracy, and predictive power. Pattern Formation in Morphogenesis Problems and Mathematical Issues Springer Science & Business Media Pattern Formation in Morphogenesis is a rich source of interesting and challenging mathematical problems. The volume aims at showing how a combination of new discoveries in developmental biology and associated modelling and computational techniques has stimulated or may stimulate relevant advances in the field. Finally it aims at facilitating the process of unfolding a mutual recognition between Biologists and Mathematicians of their complementary skills, to the point where the resulting synergy generates new and novel discoveries. It offers an interdisciplinary interaction space between biologists from embryology, genetics and molecular biology who present their own work in the perspective of the advancement of their specific fields, and mathematicians who propose solutions based on the knowledge grasped from biologists. Discrete and Continuous Dynamical Systems Series B. System Engineering Approach to Planning Anticancer Therapies Springer This book focuses on the analysis of cancer dynamics and the mathematically based synthesis of anticancer therapy. It summarizes the current state-of-the-art in this field and clarifies common misconceptions about mathematical modeling in cancer. Additionally, it encourages closer cooperation between engineers, physicians and mathematicians by showing the clear benefits of this without stating unrealistic goals. Development of therapy protocols is realized from an engineering point of view, such as the search for a solution to a specific control-optimization problem. Since in the case of cancer patients, consecutive measurements providing information about the current state of the disease are not available, the control laws are derived for an open loop structure. Different forms of therapy are incorporated into the models, from chemotherapy and antiangiogenic therapy to immunotherapy and gene therapy, but the class of models introduced is broad enough to incorporate other forms of therapy as well. The book begins with an analysis of cell cycle control, moving on to control effects on cell population and structured models and finally the signaling pathways involved in carcinogenesis and their

influence on therapy outcome. It also discusses the incorporation of intracellular processes using signaling pathway models, since the successful treatment of cancer based on analysis of intracellular processes, might soon be a reality. It brings together various aspects of modeling anticancer therapies, which until now have been distributed over a wide range of literature. Written for researchers and graduate students interested in the use of mathematical and engineering tools in biomedicine with special emphasis on applications in cancer diagnosis and treatment, this self-contained book can be easily understood with only a minimal basic knowledge of control and system engineering methods as well as the biology of cancer. Its interdisciplinary character and the authors' extensive experience in cooperating with clinicians and biologists make it interesting reading for researchers from control and system engineering looking for applications of their knowledge. Systems and molecular biologists as well as clinicians will also find new inspiration for their research. Transport Phenomena and Kinetic Theory Applications to Gases, Semiconductors, Photons, and Biological Systems Springer Science & Business Media The study of kinetic equations related to gases, semiconductors, photons, traffic flow, and other systems has developed rapidly in recent years because of its role as a mathematical tool in areas such as engineering, meteorology, biology, chemistry, materials science, nanotechnology, and pharmacy. Written by leading specialists in their respective fields, this book presents an overview of recent developments in the field of mathematical kinetic theory with a focus on modeling complex systems, emphasizing both mathematical properties and their physical meaning. Transport Phenomena and Kinetic Theory is an excellent self-study reference for graduate students, researchers, and practitioners working in pure and applied mathematics, mathematical physics, and engineering. The work may be used in courses or seminars on selected topics in transport phenomena or applications of the Boltzmann equation. Morphogenetic Engineering Toward Programmable Complex Systems Springer Generally, spontaneous pattern formation phenomena are random and repetitive, whereas elaborate devices are the deterministic product of human design. Yet, biological organisms and collective insect constructions are exceptional examples of complex systems that are both self-organized and architectural. This book is the first initiative of its kind toward establishing a new field of research, Morphogenetic Engineering, to explore the modeling and implementation of "self-architecturing" systems. Particular emphasis is placed on the programmability and computational abilities of self-organization, properties that are often underappreciated in complex systems science—while, conversely, the benefits of self-organization are often underappreciated in engineering methodologies. Altogether, the aim of this work is to provide a framework for and examples of a larger class of "self-architecturing" systems, while addressing fundamental questions such as br" How do biological organisms carry out morphogenetic tasks so reliably? br" Can we extrapolate their self-formation capabilities to

engineered systems?br" Can physical systems be endowed with information (or informational systems be embedded in physics) so as to create autonomous morphologies and functions?br" What are the core principles and best practices for the design and engineering of such morphogenetic systems? Microbial Growth Dynamics Irl Press This volume records a conference on microbial growth and population dynamics held in honour of the retirement of Professor S. John Pirt. After a general overview, it discusses mycelial growth, kinetics of secondary metabolite production and many other views. Cancer, Complexity, Computation Springer Nature This book presents unique compendium of groundbreaking ideas where scientists from many different backgrounds are united in their interest in interdisciplinary approaches towards origins and development of cancers, innovative ways of searching for cancer treatment and the role of cancer in the evolution. Chapters give an unequivocal slice of all areas that relate to a quest for understanding cancer and its origin as many-fold nonlinear system, complexity of the cancer developments, a search for cancer treatment using artificial intelligence and evolutionary optimisation, novel modelling techniques, molecular origin of cancer, the role of cancer in evolution of species, interpretation of cancer in terms of artificial life and artificial immune systems, swarm intelligence, cellular automata, computational systems biology, genetic networks, cellular computing, validation through in vitro/vivo tumour models and tumour on chip devices. The book is an inspiring blend of theoretical and experimental results, concepts and paradigms. Distinctive features The book advances widely popular topics of cancer origin, treatment and understanding of its progress The book is comprised of unique chapters written by world top experts in theoretical and applied oncology, complexity theory, mathematics, computer science. The book illustrates attractive examples of mathematical and computer models and experimental setups. Endocrinology Includes "references" and "abstracts." Towards a Theory of Development Oxford University Press Is it possible to explain and predict the development of living things? What is development? Answers to these innocuous questions are far from straightforward. To date, no systematic, targeted effort has been made to construct a unifying theory of development. This text offers a unique exploration of the foundations of ontogeny by asking how the development of living things should be understood. It explores the key concepts of developmental biology, asks whether general principles of development can be discovered, and examines the role of models and theories. This book analyses a wealth of approaches to concepts, models and theories of development, such as gene regulatory networks, accounts based on systems biology and on physics of soft matter, the different articulations of evolution and development, symbiont-induced development, as well as the widely discussed concepts of positional information and morphogenetic field, the idea of a 'programme' of development and its critiques, and the long-standing opposition between preformationist and epigenetic conceptions

of development. -- Multiscale Cancer Modeling CRC Press Cancer is a complex disease process that spans multiple scales in space and time. Driven by cutting-edge mathematical and computational techniques, in silico biology provides powerful tools to investigate the mechanistic relationships of genes, cells, and tissues. It enables the creation of experimentally testable hypotheses, the integration of data across scales, and the prediction of tumor progression and treatment outcome (in silico oncology). Drawing on an interdisciplinary group of distinguished international experts, Multiscale Cancer Modeling discusses the scientific and technical expertise necessary to conduct innovative cancer modeling research across scales. It presents contributions from some of the top in silico modeling groups in the United States and Europe. The ultimate goal of multiscale modeling and simulation approaches is their use in clinical practice, such as supporting patient-specific treatment optimization. This volume covers state-of-the-art methods of multiscale cancer modeling and addresses the field's potential as well as future challenges. It encourages collaborations among researchers in various disciplines to achieve breakthroughs in cancer modeling. Chemical Engineering Education Evolutionary Transitions to Multicellular Life Principles and mechanisms Springer The book integrates our understanding of the factors and processes underlying the evolution of multicellularity by providing several complementary perspectives (both theoretical and experimental) and using examples from various lineages in which multicellularity evolved. Recent years marked an increased interest in understanding how and why these transitions occurred, and data from various fields are providing new insights into the forces driving the several independent transitions to multicellular life as well as into the genetic and molecular basis for the evolution of this phenotype. The ultimate goal of this book is to facilitate the identification of general and unifying principles and mechanisms. Towards a Mathematical Theory of Complex Biological Systems World Scientific This monograph has the ambitious aim of developing a mathematical theory of complex biological systems with special attention to the phenomena of ageing, degeneration and repair of biological tissues under individual self-repair actions that may have good potential in medical therapy. The approach to mathematically modeling biological systems needs to tackle the additional difficulties generated by the peculiarities of living matter. These include the lack of invariance principles, abilities to express strategies for individual fitness, heterogeneous behaviors, competition up to proliferative and/or destructive actions, mutations, learning ability, evolution and many others. Applied mathematicians in the field of living systems, especially biological systems, will appreciate the special class of integro-differential equations offered here for modeling at the molecular, cellular and tissue scales. A unique perspective is also presented with a number of case studies in biological modeling. Contents:Looking for a Mathematical Theory of Biological SystemsOn the Complexity of Biological SystemsImmune System,

Wound Healing Process, and System Biology:The Immune System: A Phenomenological OverviewWound Healing Process and Organ RepairFrom Levels of Biological Organization to System BiologyMathematical Tools:Mathematical Tools and StructuresMultiscale Modeling: Linking Molecular, Cellular, and Tissues ScalesApplications and Research Perspectives:A Model for the Malign Keloid Formation and Immune System CompetitionMacroscopic Models of Chemotaxis by KTAP Asymptotic MethodsLooking Ahead Readership: Researchers in mathematical modeling and biological systems. Keywords:Mathematical Theory;Biological Systems;SubsystemKey Features:Provides a new conceptual background to applied mathematicians involved in the challenging research field of living systems, and specifically biology systemsGives more accurate ODE, cellular-automata, and continuum models from the biological point of view Artificial Life The Proceedings ... Consists of the proceedings of: 1987, Interdisciplinary Workshop on the Synthesis and Simulation of Living Systems; 1990-1992, Artificial Life Workshop; 1994-1996, International Workshop on the Synthesis and Simulation of Living Systems; 1998- , International Conference on Artificial Life. Complex Systems — Operational Approaches in Neurobiology, Physics, and Computers Proceedings of the International Symposium on Synergetics at Schloß Elmau, Bavaria, May 6–11, 1985 Springer Science & Business Media **A great deal of the success of science has rested on its specific methods. One of which has been to start with the study of simple phenomena such as that of falling bodies, or to decompose systems into parts with well-defined properties simpler than those of the total system. In our time there is a growing awareness that in many cases of great practical or scientific interest, such as economics or the hu man brain, we have to deal with truly complex systems which cannot be decomposed into their parts without losing crucial properties of the total system. In addi tion, complex systems have many facets and can be looked at from many points of view. Whenever a complicated problem arises, some scientists or other people are ready to invent lots of beautiful words, or to quote Goethe "denn immer wo Begriffe feh len, dort stellt ein Wort zur rechten Zeit sich ein" ("whenever concepts are lack king, a word appears at the right time"). Quite often such a procedure gives not only the layman but also scientists working in fields different from that of the in ventor of these new words the impression that this problem has been solved, and I am occasionally shocked to see how influential this kind of "linguistics" has become. The Method of Response Function in Psychology & Sociology** WIT Press **Social (psychological and sociological) systems present considerable difficulties for modellers due to their complexity, multidimensionality, uncertainty and irreducibility. The book proposes that response functions (MRF) be used as a method of constructing purposeful, credible and integrated social systems' models from data and prior knowledge or information. A semi-empirical, or "grey-box", MRF model may be regarded as a trade-off between a knowledge-based model and a "black-box" (empirical) model. It may embody all the existing knowledge on the**

process (or a part thereof) and, in addition, it relies on parameterised functions, whose parameters are determined from measurements. Observations contain hidden information on the processes under consideration and one of the main purposes of the proposed method is to "extract" and describe these hidden relationships. Parameterisation offers ways to couple qualitative with quantitative analysis. This combination makes it possible to take into account all the phenomena that are not modelled with the required accuracy through prior knowledge. Although only a simplified picture of the processes is modelled, a "grey box" system model provides some insight into the system processes. These processes are featured by chains of causality, highlighting stressors and variables responsive to stressors. The method of response functions is a nonlinear regression method that implies credible models in the sense that they are identifiable and, hopefully, explain system output behaviour satisfactorily. For case studies the authors have selected the problems usually studied by psychologists and sociologists with statistical procedures, such as investigation of variance and discriminant analysis based on the general linear model or one of its multivariate generalisations (structural equation models, etc.); disordered eating and obesity; subjective well-being and alexithymia. An accompanying CD-ROM contains the demonstration versions of three models that are discussed in the various chapters.The Method of Response Functions in Psychology and Sociology is aimed at Mathematical Psychologists; Mathematical Sociologists; Applied Psychologists; Sociologists and Social Practitioners. It will also be suitable for use on undergraduate as well as graduate and postgraduate courses specializing in these areas. Animal Locomotion Springer Science & Business Media The physical principles of swimming and flying in animals are intriguingly different from those of ships and airplanes. The study of animal locomotion therefore holds a special place not only at the frontiers of pure fluid dynamics research, but also in the applied field of biomimetics, which aims to emulate salient aspects of the performance and function of living organisms. For example, fluid dynamic loads are so significant for swimming fish that they are expected to have developed efficient flow control procedures through the evolutionary process of adaptation by natural selection, which might in turn be applied to the design of robotic swimmers. And yet, sharply contrasting views as to the energetic efficiency of oscillatory propulsion – especially for marine animals – demand a careful assessment of the forces and energy expended at realistic Reynolds numbers. For this and many other research questions, an experimental approach is often the most appropriate methodology. This holds as much for flying animals as it does for swimming ones, and similar experimental challenges apply – studying tethered as opposed to free locomotion, or studying the flow around robotic models as opposed to real animals. This book provides a wide-ranging snapshot of the state-of-the-art in experimental research on the physics of swimming and flying animals. The resulting picture reflects not only upon the questions that are of

interest in current pure and applied research, but also upon the experimental techniques that are available to answer them. **The Dynamic Architecture of a Developing Organism An Interdisciplinary Approach to the Development of Organisms** Springer Science & Business Media **For anybody capable of an emotional response to it, any view of a developing organism should give birth to a feeling of amazement and even admiration, whether this development is seen directly, or in the form of a time lapse film, or even if mentally reconstructed from a series of static images. We ask ourselves how such seemingly primitive eggs or pieces of tissue, without any obvious intervention from outside, so regularly transform themselves into precisely constructed adult organisms. If we try to formulate what amazes us most of all about development, the answer will probably be that it is the internal capacity of developing organisms themselves to create new structures. How, then, can we satisfy our amazement in ways that are more or less reasonable, as well as scientifically valuable? This depends, first of all, on what position we choose to regard embryonic development as occupying among other structure creating processes, even including human activities. On the one hand, one might regard the development of organisms as a highly specialized class of processes, unique to themselves and alien to the general laws of nature, or at least not derivable from them and more akin to the deliberate acts of our own human behaviour. In that case our task would become reduced to a search for some specific 'instructions' for each next member of such a class. Whether in an overt or hidden form, some such ideology seems to dominate in present day developmental biology. Mosaic Cloud Dynamics** Academic Press **As models of the Earth/atmosphere system and observations become ever more sophisticated, and concerns about climate change and societal impacts of extreme weather and its forecasting grow, understanding the role of clouds in the atmosphere is increasingly vital. Cloud Dynamics, Second Edition provides the essential information needed to understand how clouds affect climate and weather. This comprehensive book examines the underlying physics and dynamics of every specific type of cloud that occurs in the Earth's atmosphere, showing how clouds differ dynamically depending on whether they occur over oceans or mountains, or as parts of atmospheric storms, such as thunderstorms, tropical cyclones, or warm and cold fronts. Covering both the microphysical and macrophysical aspects of clouds, the book treats all of the physical scales involved in cloud processes, from the microscale of the individual drops and ice particles up to scales of storms in which the clouds occur. As observational technology advances with increasingly sophisticated remote sensing capabilities, detailed understanding of how the dynamics and physics of clouds affect the quantities being measured is of paramount importance. This book underpins the work necessary for proper interpretation of these observations, now and in the future. Provides the holistic understanding of clouds needed to pursue research on topics vital to life on Earth Provides in-depth understanding of all types of clouds over all regions of Earth, from**

the poles to the equator Includes detailed physical and dynamical insight into the entire spectrum of clouds populating Earth's atmosphere A Quest Towards a Mathematical Theory of Living Systems Birkhäuser This monograph aims to lay the groundwork for the design of a unified mathematical approach to the modeling and analysis of large, complex systems composed of interacting living things. Drawing on twenty years of research in various scientific fields, it explores how mathematical kinetic theory and evolutionary game theory can be used to understand the complex interplay between mathematical sciences and the dynamics of living systems. The authors hope this will contribute to the development of new tools and strategies, if not a new mathematical theory. The first chapter discusses the main features of living systems and outlines a strategy for their modeling. The following chapters then explore some of the methods needed to potentially achieve this in practice. Chapter Two provides a brief introduction to the mathematical kinetic theory of classical particles, with special emphasis on the Boltzmann equation; the Enskog equation, mean field models, and Monte Carlo methods are also briefly covered. Chapter Three uses concepts from evolutionary game theory to derive mathematical structures that are able to capture the complexity features of interactions within living systems. The book then shifts to exploring the relevant applications of these methods that can potentially be used to derive specific, usable models. The modeling of social systems in various contexts is the subject of Chapter Five, and an overview of modeling crowd dynamics is given in Chapter Six, demonstrating how this approach can be used to model the dynamics of multicellular systems. The final chapter considers some additional applications before presenting an overview of open problems. The authors then offer their own speculations on the conceptual paths that may lead to a mathematical theory of living systems hoping to motivate future research activity in the field. A truly unique contribution to the existing literature, A Quest Toward a Mathematical Theory of Living Systems is an important book that will no doubt have a significant influence on the future directions of the field. It will be of interest to mathematical biologists, systems biologists, biophysicists, and other researchers working on understanding the complexities of living systems. Genetic Programming 13th European Conference, EuroGP 2010, Istanbul, Turkey, April 7-9, 2010, Proceedings Springer Science & Business Media rangefromsolvingdi?erentialequations,routingproblems to ?le type detection, object-oriented testing, agents. This year we received 48 submissions, of which 47 were sent to the reviewers. Self-Organization in the Nervous System Frontiers Media SA This special issue reviews state-of-the-art approaches to the biophysical roots of cognition. These approaches appeal to the notion that cognitive capacities serve to optimize responses to changing external conditions. Crucially, this optimisation rests on the ability to predict changes in the environment, thus allowing organisms to respond pre-emptively to changes before their onset. The biophysical

mechanisms that underwrite these cognitive capacities remain largely unknown; although a number of hypotheses has been advanced in systems neuroscience, biophysics and other disciplines. These hypotheses converge on the intersection of thermodynamic and information-theoretic formulations of self-organization in the brain. The latter perspective emerged when Shannon's theory of message transmission in communication systems was used to characterise message passing between neurons. In its subsequent incarnations, the information theory approach has been integrated into computational neuroscience and the Bayesian brain framework. The thermodynamic formulation rests on a view of the brain as an aggregation of stochastic microprocessors (neurons), with subsequent appeal to the constructs of statistical mechanics and thermodynamics. In particular, the use of ensemble dynamics to elucidate the relationship between micro-scale parameters and those of the macro-scale aggregation (the brain). In general, the thermodynamic approach treats the brain as a dissipative system and seeks to represent the development and functioning of cognitive mechanisms as collective capacities that emerge in the course of self-organization. Its explicanda include energy efficiency; enabling progressively more complex cognitive operations such as long-term prediction and anticipatory planning. A cardinal example of the Bayesian brain approach is the free energy principle that explains self-organizing dynamics in the brain in terms of its predictive capabilities – and selective sampling of sensory inputs that optimise variational free energy as a proxy for Bayesian model evidence. An example of thermodynamically grounded proposals, in this issue, associates self-organization with phase transitions in neuronal state-spaces; resulting in the formation of bounded neuronal assemblies (neuronal packets). This special issue seeks a discourse between thermodynamic and informational formulations of the self-organising and self-evidencing brain. For example, could minimization of thermodynamic free energy during the formation of neuronal packets underlie minimization of variational free energy? Heredity Produced At the Crossroads of Biology, Politics, and Culture, 1500-1870 MIT Press Until the middle of the eighteenth century, the biological makeup of an organism wasascribed to an individual instance of "generation"--involving conception, pregnancy, embryonicdevelopment, parturition, lactation, and even astral influences and maternal mood--rather than thebiological transmission of traits and characteristics. Discussions of heredity and inheritance tookplace largely in the legal and political sphere. In Heredity Produced, scholars from a broad rangeof disciplines explore the development of the concept of heredity from the early modern period tothe era of Darwin and Mendel.The contributors examine the evolution of the concept in disparatecultural realms--including law, medicine, and natural history--and show that it did not coalesceinto a more general understanding of heredity until the mid-nineteenth century. They considerinheritance and kinship in a legal context; the classification of

certain diseases as hereditary;the study of botany; animal and plant breeding and hybridization for desirable characteristics;theories of generation and evolution; and anthropology and its study of physical differences amonghumans, particularly skin color. The editors argue that only when people, animals, and plants becamemore mobile--and were separated from their natural habitats through exploration, colonialism, andother causes--could scientists distinguish between inherited and environmentally induced traits anddevelop a coherent theory of heredity. The Development of Animal Form Ontogeny, Morphology, and Evolution Cambridge University Press **Contemporary research in the field of evolutionary developmental biology, or 'evo-devo', has to date been predominantly devoted to interpreting basic features of animal architecture in molecular genetics terms. Considerably less time has been spent on the exploitation of the wealth of facts and concepts available from traditional disciplines, such as comparative morphology, even though these traditional approaches can continue to offer a fresh insight into evolutionary developmental questions. The Development of Animal Form aims to integrate traditional morphological and contemporary molecular genetic approaches and to deal with post-embryonic development as well. This approach leads to unconventional views on the basic features of animal organization, such as body axes, symmetry, segments, body regions, appendages and related concepts. This book will be of particular interest to graduate students and researchers in evolutionary and developmental biology, as well as to those in related areas of cell biology, genetics and zoology. Ultradian Rhythms in Life Processes An Inquiry into Fundamental Principles of Chronobiology and Psychobiology** Springer Science & Business Media **Profound progress has been made in the fields of chronobiology and psychobiology within the past decade, in theory, experiment and clinical application. This volume integrates these new developments on all levels from the molecular, genetic and cellular to the psycho social processes of everyday life. We present a balanced variety of research from workers around the globe, who discuss the funda mental significance of their approach for a new understanding of the central role of ultradian rhythms in the self-organizing and adaptive dynamics of all life processes. The years since the publication of Ultra dian rhythms in physiology and behavior by Schultz and Lavie in 1985 have seen a burgeoning realization of the ubiquity and importance of ultradian rhythms within and between every level of the psychobiological hierarchy. The experimental evidence lies scattered through a disparate litera ture, and this volume attempts, albeit in a highly selective manner, to bring together some of the different strands. The editors are very conscious of the omission of many important current aspects; e.g. we have not included any of the fascinating and indeed long and well-established experiments with plants (Bunning 1971, 1977; Guillaume and Koukkari 1987; Millet et al. 1988; 10hnsson et al. 1990) that are widely regarded as having initiated the whole field of chronobiology (De Mairan 1729). Neither have we reviewed recent**

developments on glycolytic oscillations, since a great deal of the seminal work was already completed by 1973 (Chance et al. 1973). Growth, Differentiation and Sexuality Springer This new edition offers detailed overviews covering a wide area of fungal growth and reproduction on the mechanistic and molecular level. It includes 18 chapters by eminent scientists in the field and is – like the previous edition – divided into the three sections: Vegetative Processes and Growth, Signals in Growth and Development, and Reproductive Processes. Major topics of the first section include dynamic intracellular processes, apical growth, hyphal fusion, and aging. The second section analyses autoregulatory signals, pheromone action, and photomorphogenesis and gravitropism abiotic signals. The third section reveals details of asexual and sexual development in various fungal model systems, culminating in fruit body formation in basidiomycetes, which is a sector of growing economic potential. Since the publication of the first edition of this volume in 1994 and the second edition in 2006, the field of fungal biology has continued to expand thanks to improvements in omics technologies and the application of genetic tools to an increasing variety of fungal models. Several additional chapters by a new generation of fungal biologists discuss this diversity and guarantee lively reading. Artificial Life An Overview MIT Press This book brings together a series of overview articles that appeared in the first three issues of the groundbreaking journal Artificial Life.